MICROCLIMATE OF ANOPHELES HYRCANUS AND ANOPHELES MACULIPENNIS HABITATS IN RICE FIELDS

TRANSLATION NO. 1159

August 1964

UNITED STATES ARMY
BIOLOGICAL LABORATORIES
Fort Detrick, Frederick, Maryland

DDC AVAILABILITY NOTICE

Qualified requestors may obtain copies of this document from DDC.

This publication has been translated from the open literature and is available to the general public. Non-DOD agencies may purchase this publication from Clearinghouse for Federal Scientific and Technical Information, U. S. Department of Commerce, Springfield, Va.

Technical Library Branch
Technical Information Division

MICROCLIMATE OF ANOPHELES HYRCANUS AND ANOPHELES MACULIPENNIS HABITATS IN RICE FIELDS

/Following is the translation of an article by N. P. Sokolov in the Russian-language journal Meditsinskaya Parazitologiya i Parazitarnyye Bolezni (Medical Parasitology and Parasitic Illnesses), No 6, 1963, pages 725-728./

From the Department of General Biology and Parasitology (Director: Professor N. P. Sokolov) of the Andizhan Medical Institute

(Received 17 May 1961)

Observations on the microclimate of habitats of Anopheles hyrcanus and ~~Maculipennis~~ maculipennis sacharovi were carried out in the region of the Uzbekistan Rice Test Station. The habitats of A. hyrcanus are usually thickets of velvet grass (Holcus mollis) in rice fields. In living quarters, in places where domestic animals are kept, this species is found very rarely. The habitats of A. m. sacharovi are stables.

~~We present the~~ results of observation on soil and air temperature, humidity and wind velocity in habitats of mosquitoes and their comparison with the microclimate of the open area of the meteorological station located in the vicinity. Data obtained upon measurements of solar radiation in the biotopes A. Hyrcanus and A. m. sacharovi have been published previously. (Meditsinskaya parazitologiya i parazitarnyye bolezni /Medical Parasitology and Parasitic Diseases/, 1961, No 5).

The temperatures of plant-covered (velvet grass) and exposed soil differed. Plant cover protects soil from intense insolation during the daylight hours and, therefore, significantly reduces the immediate influx of heat into the soil. During the night hours,

...t, in contrast, impedes irradiation which reduces the outflow of heat from the soil. In addition, the vegetation impedes turbulent mixing of the air, reduces heat capacity of the soil through evaporation and acts on other processes related to the presence of vegetation. Table 1 illustrates data of soil temperature measurements in vegetation overgrowth and for the area of the meteorological station.

TABLE 1

Diurnal Course of Soil Temperature in Thickets of Vegetation (velvet grass) and in the Area of the Meteorological Station (in degrees)

a) Часы [illegible]людения	b) [illegible]6–27/VII		c) [illegible]–10/VIII	
	d) [illegible]осли [illegible]рняка	e) площадка метеостанции	d) заросли курняка	e) площадка метеостанции
7	20,2	20,4	19,8	19,7
13	26	41	23,8	37,5
21	23	24,3	23,6	24,1
f) [illegible]	22,7	28	22,3	26,[illegible]
g) [illegible]ная	20,1	20,4	19,1	19,7
h) [illegible]ная	25,4	41	24,8	37,5

LEGEND: a) hours of observation; b) 26-27 July; c) 9-10 August; d) overgrowth of velvet grass; e) area of meteorological station; f) mean; g) minimal; h) maximal.

Measurements made in the open area of the meteorological station hourly during 26-27 July and 9-10 September [Table 1 shows 9-10 August] revealed a large difference in the soil temperature in velvet grass stands and in the area of the meteorological station. The soil temperature in the station area free of vegetation was 13.7-15° higher during the midday hours (13 hours) than in the velvet grass areas; during the morning and evening hours the difference levels off. The mean-diurnal temperature of the soil in the velvet grass areas on 26-27 July was 5.3° lower than the temperature of soil devoid of vegetation; the maximum temperature of the exposed soil reached 41°, while among the areas of vegetation it did not exceed 25.4 %.

The diurnal course of soil temperature during other days was similar to the data presented above. The most intense heating of soil in the velvet grass areas took place during the post-midday hours; before noon the temperature gradually increased, but then gradually decreased.

Plant cover also has an essential effect on distribution of air temperature along the vertical. At the surface of the plant cover (at a distance of 160 cm from the soil), during the daylight hours, the temperature as a rule was above that of layers of air surrounding the soil -- at a distance of 10 cm from the soil (Table 2). For comparison, we present data on other biotopes.

TABLE 2

Diurnal Course of Air Temperature at Different Stations According to Measurements Made on 9-10 September

a)	b)	c)		d)	
		e)	f)	g)	h)
9	[illegible]	[illegible]	[illegible]	[illegible]	—
10	[illegible]	25,4	[illegible]	30,2	—
11	[illegible]	[illegible]	32,2	[illegible]	—
12	[illegible]	28,2	32,2	[illegible]	—
[illegible]	35			[illegible]	[illegible]
[illegible]	35,2	[illegible]	[illegible]	33	—
15	[illegible]	26,8	35	[illegible]	—
16	[illegible]	28,2	32,8	[illegible]	—
17	34,2	27,6	[illegible]	[illegible]	—
18	32,2	[illegible]	29,8	31,8	—
19	27,2	[illegible]	[illegible]	30,0	—
20	23,8	[illegible]	23,4	[illegible]	—
21	—	22	[illegible]	27,4	24,1
22	—	20,6	[illegible]	25,4	—
23	—	[illegible]	[illegible]	—	—
24	19,6	[illegible]	[illegible]	23,8	—
1	—	[illegible]	[illegible]	22,8	—
2	—	[illegible]	[illegible]	22,2	—
3	—	[illegible]	[illegible]	[illegible]	—
4	—	[illegible]	17,8	20,2	—
5	[illegible]	[illegible]	[illegible]	20,2	—
6	[illegible]	[illegible]	17,3	22,2	—
i)	29,6	[illegible]	[illegible]	27,7	
j)	16,3	[illegible]	17,6	20,2	
k)	33,2	[illegible]	[illegible]	33,8	

LEGEND: a) hours of observation; b) area devoid of vegetation (150 cm from soil); c) within and on the surface of plant cover; d) air temperature (in degrees); e) 10 cm from soil; f) 160 cm from soil; g) in stable; h) [not legible]; i) mean; j) minimal; k) maximal.

The difference in the air temperature between the biotopes of the velvet grass stands and the stable during different hours of the day increased to as much as 5°. The air temperature of the stable as a rule was much higher than the temperature within the plant cover.

In the rice-planting zones, due to intensive evaporation of water both by plants (rice) as well as at the surface of the water during the entire vegetative period, a high relative humidity was maintained. Its deficit in various biotopes is shown in Table 3. Within the velvet grass stands, the relative humidity during the day was very high (81-100°); even during the daylight hours the air here was almost totally saturated. The humidity was still higher in the rice field, which can be accounted for by the presence of large expanses of water surface. The humidity deficit here as a rule was very low. Within the rice, this variable during the daylight hours was lower than at the surface of the rice.

Diurnal values of the relative humidity in all the biotopes studied were in the opposite direction to temperature changes; the highest humidity was observed during the night and morning hours; during this period sharply decided differences between the open surfaces of the soil (lacking vegetation) and the near-surface layer of air within the vegetation disappeared.

The difference of the indices examined between the biotopes of velvet grass and stable was very decided. The relative humidity during the day ranged within the stable within the limits 53-83 %, and within the plant cover -- within the limits 85-100°. Air within the plant cover was saturated with moisture or close to the saturated state during the hole day, while in the stable a relatively high moisture deficit was noted, especially during the daylight hours.

The significance of the wind as an ecological factor is accounted for by various factors. Wind in addition to moisture deficiency is an essential factor in evaporation. Its role amounts to carrying off from the evaporating surface water vapor, in place of which air at a lower humidity enters the surrounding environment, which intensifies the process of evaporation. As observations revealed, the wind velocity above the plant cover (rice and velvet grass) was relatively low.

Analysis of the data obtained permitted us to establish a decided difference between the microclimates of the biotopes of A. hyrcanus and A. m. sacharovi. The first species undergoes greater exposure to meteorological factors than does the first. The role of vegetation in establishing the microclimate of A. hyrcanus habitats is exceptionally important. The species composition of vegetation plays no part here. We mowed velvet grass over large areas and nonetheless the mosquitoes persistently remained under the cut plants, since temperature and humidity conditions at the sites did not differ from the microclimate of the velvet grass stands.

Thus, biotopes of A. hyrcanus in rice fields are characterized by the following features: 1) lower air temperature and relatively high illumination compared to the biotopes of A. m. sacharovi, since plant cover although shielded during the day from the effect of direct solar radiation, is not completely protected; 2) very low humidity

deficit. The extent of moisture saturation of the air determines the intensity of water evaporation for the mosquitoes and is vital to their life activity. Evaporation of water from the insect body within the limits of a definite temperature range, as is known, increases proportional to the humidity deficit. Evaporation regulates mosquito body temperature, since the outflow of the heat through evaporation proceeds for mosquitoes much more intensively than through thermal radiation and thermal conductivity. A. hyrcanus exhibits adaptation to high humidity; therefore, it can be assumed that evaporation is retarded in these insects.

Diurnal Changes in Relative Humidity and Humidity Deficit in Different Stages from Measurements Made 9-10 August

a Часы наблюдения	b Обнаженная от растительности площадка		c Внутри зарослей курмака на расстоянии 10 см от почвы		d Конюшня		e Метеорологическая будка
	f относительная влажность (в %)	g дефицит влажности (в мм)	f относительная влажность (в %)	g дефицит влажности (в мм)	f относительная влажность (в %)	g дефицит влажности (в мм)	g дефицит влажности (в мм)
7	—	—	—	—	—	—	8,2
9	49	15,4	99	0,9	62	10	—
10	61	12,4	85	4,0	60	11,5	—
11	61	12,7	89	3,6	63	15,8	
12	55	10,7	92	2,1	64	11,2	—
13	61	15,7	—	—	67	10,1	25,2
14	42	22,1	93	2,1	52	12,9	—
15	61	15,3		2,7	58	15	
16	64	14,8	95	5,0	75	9,0	
17	59	15,8	91	1,4	59	15,6	
18	70	8,6	94	1,5	69	11	
19	8,	5,7	95	1,2	73	8,6	
20	75	6,8	100	—	62	4,9	2,9
21	—	—	—	—	—	—	3,9
22	8[illegible]	2,5	100	—	76	5,8	—
23							
24	95	0,7	100	—	79	15,1	—
1	100	—	100	—	80	4,2	—
2	100	—	100	—	83	3,3	—
3	91	1,5	100	—	88	2,4	—
4	91	1,6	100	—	74	4,7	—
5	81	2,9	100	—	83	3,1	—
6	70	3,7	100	—	72	5,5	—
h Средняя	73	9,7	95	2,3	70,8	8,5	11,4
i Минимальная	42	0,7	85	0,9	53	2,4	2,9
j Максимальная	100	22,1	100	5	88	15,8	25,2

LEGEND: a) hours of observations; b) site shaded by vegetation; c) within thickets of velvet grass 10 cm from soil; d) stables; e) meteorological stall; f) relative humidity (in %); g) humidity deficit (in mm); h) mean; i) minimal; j) maximal.